Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 18 (2): 385–390
https://doi.org/10.15560/18.2.385

PENSOFT

Range and elevation extension for the Yunnan Water Snake, *Trimerodytes yunnanensis* (Rao & Yang, 1998) (Serpentes, Colubridae), from Thailand and some notes on its natural history

Patchara Danaisawadi[1*], Wut Taksinthum[1]

1 Department of Zoology, Kasetsart University, Bangkok, Thailand • PD: fscipad@ku.ac.th https://orcid.org/0000-0001-7267-1127 • WT: fsciwut@ku.ac.th

* Corresponding author

Abstract

Trimerodytes yunnanensis (Rao & Yang, 1998), Mountain Water Snake, mainly occurs at elevations of more than 1,000 m above sea level (a.s.l.). We provide both a range extension to Lampang, Thailand, and the lowest known elevation record for this species at 400 m a.s.l. This record is also the southernmost known occurrence of *T. yunnanensis* and the genus as a whole. In addition, a morphological description of the juvenile, ecological notes in the field, and feeding habits in captivity are provided.

Keywords

Ecological notes, Lampang, lowland habitat, reptiles

Academic editor: Perry L. Wood, Jr. | Received 18 January 2022 | Accepted 4 April 2022 | Published 19 April 2022

Citation: Danaisawadi P, Taksinthum W (2022) Range and elevation extension for the Yunnan Water Snake, *Trimerodytes yunnanensis* (Rao & Yang, 1998) (Serpentes, Colubridae), from Thailand and some notes on its natural history. Check List 18 (2): 385–390. https://doi.org/10.15560/18.2.385

Introduction

The snake genus *Trimerodytes* Cope, 1895 belongs to the family Colubridae and consists of six species (Uetz 2021), *T. aequifasciatus* (Barbour, 1908), *T. annularis* (Hallowell, 1856), *T. balteatus* Cope, 1895, *T. percarinatus* (Boulenger, 1899), *T. yapingi* (Gou, Zhu & Liu, 2019), and *T. yunnanensis* (Rao & Yang, 1998). *Trimerodytes* are aquatic snakes, commonly found near streams, ponds, and lakes, and generally feed on fish (Pauwels et al. 2009; Das 2010; Chan-ard et al. 2015; Das 2018). *Trimerodytes* is endemic to East and Southeast Asia and is generally recognized as mountain species because they occurr at higher altitudes (Rao and Yang 1998; Pauwels et al. 2009; Le et al. 2015).

Trimerodytes yunnanensis was originally described from southern China by Rao and Yang (1998) in the genus *Sinonatrix* Rossman & Eberle, 1977. However, after re-examining morphological characters and its phylogenetic relationships, Ren et al. (2019) placed this species in the genus *Trimerodytes*. The distribution of *T. yunnanensis* is fragmented, and it has been reported from southern China, Thailand (Chiang Rai Province) (Pauwels et al. 2009), Vietnam (Son La Province) (Le et al. 2015), and northern Myanmar (Kachin state) (Wogan et al. 2008). *Trimerodytes yunnanensis* strictly inhabits the vicinity of aquatic habitats in montane forests ranging from 900 to 2000 m a.s.l. (Rao and Yang, 1998; Pauwels et al. 2009; Le et al. 2015).

During a field survey in August 2019 in Lampang Province, northern Thailand, a juvenile specimen of *T. yunnanensis* was found, which provides the first sighting

©The authors. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

of this species in a lowland habitat. Here, we provide a morphological description and compare this specimen to others from Thailand and with reports in the literature. We also provide ecological notes in the field and feeding habits in captivity.

Methods

The specimen was found in a pond near a village in Mueang Pan District, Lampang Province, Thailand. A photograph of the snake was captured in the field. We caught the specimen using a dip net and carefully transferred it to a plastic box. In the laboratory, the snake was kept at room temperature (25 °C). As a semiaquatic habitat, a 20-inch glass tank was set up where rocks and gravel separated the wet and dry areas (70/30 wet and dry parts, respectively). The snake was kept in the laboratory for a year to study its feeding patterns before the snake died naturally. The voucher specimen was preserved in 70% ethanol and deposited in the collection of the Zoological Museum Kasetsart University (ZMKU), Bangkok, Thailand. The meristics and scalations were examined for identification following Chan-ard et al. (2015). The scalations were recorded including the number of dorsal and ventral scales, number of subcaudal scales (pairs), the number of supralabial and infralabial scales. Furthermore, the number of maxillary teeth and the number of X-markings found on the trunk and tail were noted. External morphology of the snake was compared to the specimens recorded in Thailand, collection numbers QSMI 544 and QSMI 1326 which were deposited at herpetological collections of the Queen Saovabha Memorial Institute, Thai Red Cross, Bangkok. Coordinates were taken using a handheld Garmin GPSMAP 60CSx. Animal care and use protocol approval number U1-07249-2560 permits to PD. Geographic distributions were plotted using the online mapping application SimpleMappr (Shorthouse 2022).

Results

Trimerodytes yunnanensis (Rao & Yang, 1998)
Figure 1

New record. THAILAND – **Lampang** • Mueang Pan District, Chae Son Subdistrict; 18.8308°N, 099.4850°E; 400 m a.s.l.; 14. IIX. 2019; Wut Taksintum leg.; dipnet; 1 ♀ (juvenile), ZMKU_PD_0027.

Identification. Morphology-based identification was compared to the original description (Rao and Yang 1998). The specimen measured 33.9 cm in snout–vent length and 43.4 cm in total length (measurements made after the snake was deceased) and was determined to be a female by using probing technique (Laszlo 1975) when the specimen was first collected.

Body stout, cylindrical; head elongate but not distinct from neck; nuchal groove distinct; internasal narrower than prefrontal; head scalation on the left side with 1 loreal; 1 preocular; 4 postoculars; 9 supralabials with the fourth and fifth contacting orbit, the seventh largest; 10 infralabials; 31 maxillary teeth; dorsal scale rows 19-19-17 with keeled except for the lowest three rows; 158 ventral scales; divided cloacal scale; 76 pairs of subcaudal scales. The dorsum reddish-brown with 42 transverse bands, having 43 X-marks on lateral sides along the body and tail. Ventral cream; lower branch of X-markings appearing along the lateral edges of the ventral part, gradually linked medially along the venter and producing a checkered pattern towards the tail.

Based on the scalation, our specimen falls within the range of variation and coloration pattern reported for the species by Rao & Yang (1998). We compared our specimen to the specimens recorded in Thailand (Pauwels et al. 2009) and the original description (Rao and Yang 1998) (Table 1). The distinctive X-mark pattern in *Trimerodytes* species is shared between *T. aequifasciata* and *T. yunnanensis*. However, our specimen clearly differs from *T. aequifasciata* in having 31–35 maxillary teeth (vs. 23–28 maxillary teeth in *T. aequifasciata*) and 156–165 ventral scales (vs. 142–154 ventral scales).

Distribution. The holotype and paratypes of this species were collected from Yunnan Province, southern China during 1960–1991 (holotype KIZ 75II0191, adult male). All specimens were collected from high-altitude habitats between approximately 900 and 2,000 m a.s.l. from Jingdong, Menglian, Jinggu, Yongde, Lufeng, and Yunnan (Rao and Yang 1998).

Records from Myanmar were first mentioned by Wogan et al. (2008) from Kachin State, and the second report was from Putao District, Kachin State (Ren et al. 2019). However, these two records from Myanmar lacked details about the habitat or morphology of the specimens.

In Vietnam, *T. yunnanensis* were recorded for the first time by Le et al. (2015) who found three specimens in secondary forests in northwestern Vietnam. One adult male and one adult female were collected near Ta Lo San village, Sen Thuong Commune, in a buffer zone of the Muong Nature Reserve at an elevation of 1,097 m a.s.l. In addition, one adult female was collected in Sop Cop Nature Reserve, Son La Province, at an elevation of 990 m a.s.l.

In Thailand, Pauwels et al. (2009) reported the first record of *T. yunnanensis* was from a bamboo forest at approximately 1,200 m a.s.l. in Wiang Pa Pao District, Chiang Rai Province. A second specimen was discovered at the same location in April 2010, but the information about its habitat was not recorded (Tawan T, per. comm. January, 2022). Both specimens were deposited at Queen Saovabha Memorial Institute (QSMI). Moreover, photographic records from Chiang Mai and Nan Province were taken at the elevation approximately 800–1,200 m a.s.l (iNaturalist 2022).

Our specimen, the third found in Thailand, was found on 14 August 2019 at 8.30 pm. The snake was encountered in a pond surrounded by shrubs and aquatic plants near the road in Mueang Pan District, Lampang

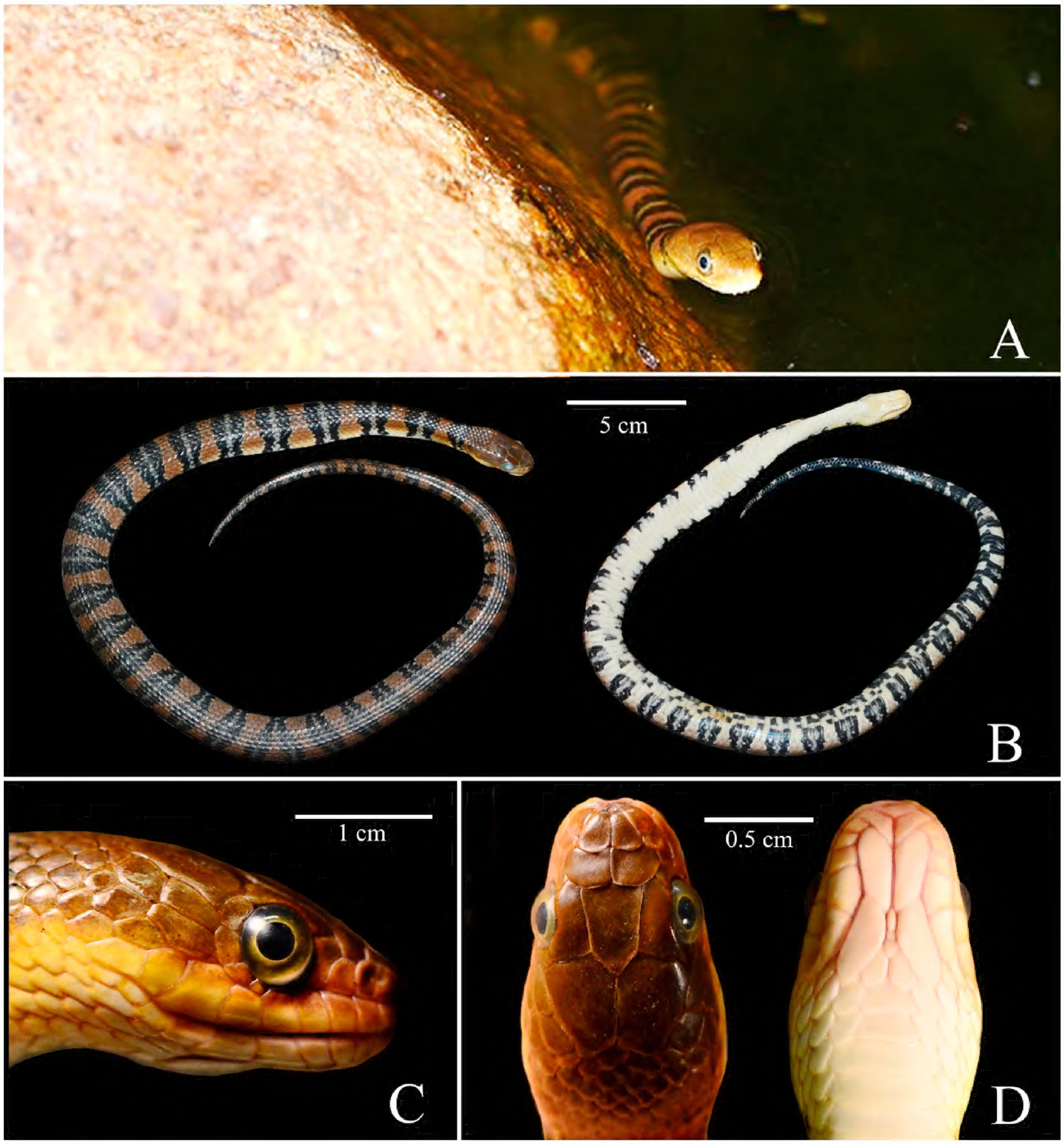

Figure 1. *Trimerodytes yunnanensis* from Mueang Pan District, Lampang province (ZMKU_PD_0027). **A.** specimen in life. **B.** dorsal and ventral views of the preserved specimen. **C.** side of the head. **D.** dorsal and ventral views of the head.

Table 1. Comparison of characters between *Trimerodytes yunnanensis* in this study and previously recorded specimens.

	Recorded specimens from Thailand			The original description of species		
	ZMKU_PD_0027	**QSMI 544**	**QSMI 1326**			
Reference	Present study	Pauwels et al. 2009	Unpublished data	Rao and Yang 1998		
Number of observed specimens	1	1	1	15	13	6
Sex	Female	Female	Male	Male	Female	Male and female
Stage	Juvenile	Adult	Adult	Adult	Adult	Juvenile
SVL (cm)	33.9	75.0	62.1	4.40–4.98× as that of tail	4.42–4.83× as that of tail	Not provided
Total length (cm)	43.4	98.5	83.7	Not provided	Not provided	Not provided
Dorsal scales	19–19–17	19–19–17	19–19–17	19–19–17	19–19–17	19–19–17
Ventral scales	158	155	159	159–165	157–161	156–165
Subcaudal (pairs)	76	72	73	68–75	61–71	66–77
Supralabial scales	9/9	9/8	9/9	9-10	9-10	9-10
Infralabial scales	10	12	10	10	10–11	10
Maxillary teeth	31	Not provided	Not provided	31–35	31–35	31–35
X-Marking body + tail	29 + 13	38 in total	27+21	21–28 + 11–17	21–28 + 11–17	21–28 + 11–17

Province, and this record extends the geographic range by 47 km south of the previously known record and by 400 km south of the type locality in China (Fig. 2). The pond where we collected our specimen was at 400 m a.s.l. Our new record is from the lowest known elevation for this species. The vegetation around the pond was predominantly covered by grassland and mixed deciduous forest.

Feeding habits in captivity. The snake spent most of its time in the water and only went onto the rock for sunbathing. It was fed *ad libitum* with aquarium fish (small white carp, molly, and small goldfish) and tadpoles of *Microhyla mukhlesuri* Yaakob & Sukumaran, 2007. The snake aggressively foraged, and it commonly fed on prey underwater, except for the large prey, which was moved up to the rock before consumption. Sometimes, the snake held large prey above the water level for a while before eating it. Interestingly, the snake preferred small goldfish to other prey provided.

Discussion

Our morphological examination of the juvenile specimen does not show significant differences from the original

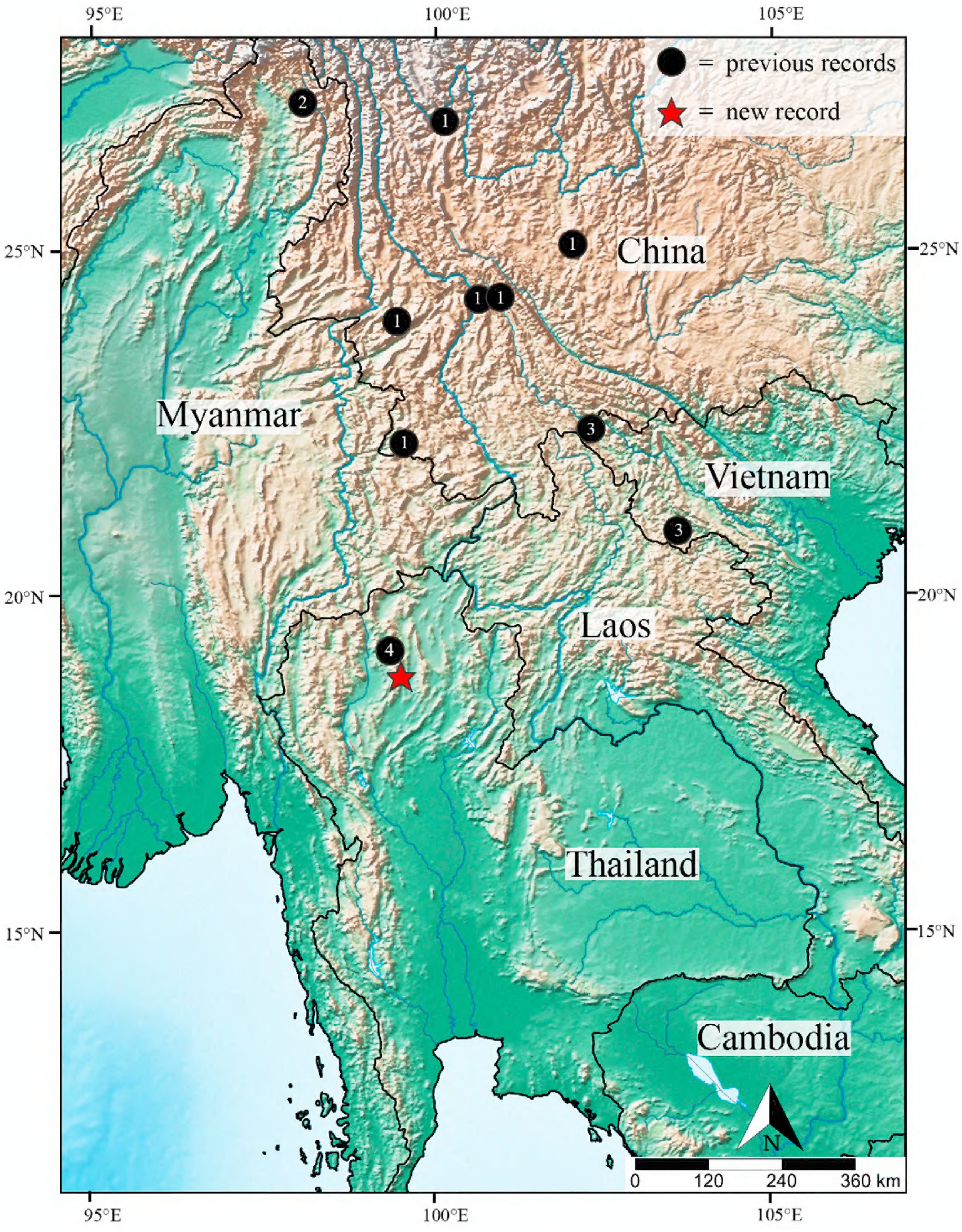

Figure 2. Geographic distribution of *Trimerodytes yunnanensis*. A red star indicates the new record of *T. yunnanensis* from Mueang Pan District, Lampang province, Thailand, and black circles indicate previous records of *T. yunnanensis* from (1) China (Rao and Yang 1998), (2) Myanmar (Wogan et al. 2008; Ren et al. 2019), (3) Vietnam (Le et al. 2015) and (4) Thailand (Pauwels et al. 2009).

description. However, the specimen QSMI 544 from Chiang Rai exhibits a more infralabial scales (12) than our specimen (10) and the original description (10 or 11). Variation in scalation may occur among juveniles and adults (Thorpe 1975; Dohm and Garland 1993; Lindell et al. 1993).

There was a difference in the color pattern of the venter between our specimen and QSMI 544. Pauwels et al. (2009) described X-markings that present on left and right sides of specimen QSMI 544 as contacting each other on the ventrum and the subcaudal part. This pattern can also be found in recent specimens. However, the ventral band of recent specimen is wider than in QSMI 544, implying that our specimen was juvenile. The color pattern of our specimen is similar to the original description by Rao and Yang (1998) and to the Vietnamese specimens described by Le et al. (2015) in which the lower branches of X-markings terminate at lateral edges of the ventral scales and start contacting each other at one-third of the body length to the tail. The ventral blotches become denser posteriorly, toward the tail and make the subcaudals black in color.

Trimerodytes yunnanensis appears to be restricted to low-temperature water, especially in montane/submontane forests (Chan-ard et al. 2015; Das 2018). However, the altitude and characteristics of the habitat of this specimen were slightly different from the previous records. The pond where we found our specimen was only at 400 m elevation a.s.l., which is the lowest altitudinal record for this species. The holotype from China and the QSMI 544 specimen were from high altitudes, 2,000 m and 1,200 m a.s.l., respectively (Rao and Yang 1998; Pauwels et al. 2009).

In terms of habitat utilization, the first recorded specimen of *T. yunnanensis* in Thailand (QSMI 544) was found in a fast-flowing rocky stream in bamboo forest (Pauwels et al. 2009). However, our specimen was encountered in standing water with muddy substrates. Interestingly, Vietnamese specimens were found in trees near rocky streams in secondary forest (Le et al. 2015). Given the present observations, lower temperatures may not be a limiting factor for the distribution of *T. yunnanensis*, and the snakes may occupy a broader range of habitat types than previously known. Unfortunately, the habitat of the holotype was not recorded.

Acknowledgements

The project was supported in part by Kasetsart University Research and Development Institute (KURDI) to PD (Grant number R-M11.63). We would like to thank Dr. Lawan Chanhome and Mr. Tanapong Tawan from Queen Saovabha Memorial Institute (QSMI) for loaning us the specimen in their collection for examination. We are also profoundly grateful to Dr. Veerayuth Laohajinda, Mr. Kittipong Lerdrungroj, and Mr. Chaiyapon Lerdkriengkriying for field assistance. We would like to extend our sincere thanks to Dr. Mesayamas Kongsema for her support, encouragement and corrections on the manuscript. We would also thank Dr. Jirasak Sutcharit for the suggestions to improve this work. Finally, we would also thank Dr. Evan S.H. Quah and Michael Cota for their constructive comments on the manuscript.

Authors' Contributions

Conceptualization: PD. Data curation: PD. Formal analysis: PD. Investigation: PD. Methodology: PD. Resources: WT. Visualization: PD. Writing – original draft: PD. Writing – review and editing: PD, WT.

References

Barbour T (1908) Some new reptiles and amphibians. Bulletin of the Museum of Comparative Zoology at Harvard College 51 (12): 315–325.

Boulenger GA (1899) On a collection of reptiles and batrachians made by Mr. J.D. La Touche in N.W. Fokien, China. Proceedings of the Zoological Society of London 1899: 159–172.

Chan-ard T, Nabhitabhata J, Parr JWK (2015) A field guide to the reptiles of Thailand. Oxford University Press, New York, USA, 352 pp.

Cope ED (1895) On a collection of Batrachia and Reptilia from the island of Hainan. The Proceedings of the Academy of Natural Sciences of Philadelphia 46: 423–428.

Das I (2010) A field guide to the reptiles of Thailand and South-East Asia. New Holland Publishers, London, UK, 376 pp.

Das I (2018) A naturalist's guide to the snakes of Southeast Asia. *2nd Edition.* John Beaufoy Publishing Ltd., Oxford, UK, 176 pp.

Dohm MR, Garland T Jr. (1993) Quantitative genetics of scale counts in the garter snake *Thamnophis sirtalis*. Copeia 4: 987–1002. https://doi.org/10.2307/1447076

Guo P, Zhu F, Liu Q (2019) A new member of the genus *Sinonatrix* (Serpentes: Colubridae) from western China. Zootaxa 4623 (3): 535–544. https://doi.org/10.11646/zootaxa.4623.3.5

Hallowell E (1857) Notes on the reptiles in the collection of the museum of the Academy of Natural Sciences. The Proceedings of the Academy of Natural Sciences of Philadelphia 8 (4): 146–153.

iNaturalist (2022) *Trimerodytes yunnanensis*. https://www.inaturalist.org. Accessed on: 2022-3-7.

Laszlo J (1975) Probing as a practical method of sex recognition in snakes. International Zoo Yearbook 15: 178–79.

Le DT, Pham AV, Pham CT, Nguyen SLH, Ziegler T, Nguyen TQ (2015) Review of the genus *Sinonatrix* in Vietnam with a new country record of *Sinonatrix yunnanensis* Rao et Yang, 1998. Russian Journal of Herpetology 22 (2): 84–88. https://doi.org/10.30906/1026-2296-2015-22-2-84-88

Lindell LE, Forsman A, Merilä J (1993) Variation in number of ventral scales in snakes: effects on body size, growth rate and survival in the adder, *Vipera berus*. Journal of Zoology 230(1): 101–115. https://doi.org/10.1111/j.1469-7998.1993.tb02675.x

Pauwels OSG, Kunya K, David P, Sumontha M (2009) First record of the Yunnan Keelback *Sinonatrix yunnanensis* Rao and Yang, 1998 (Serpentes: Natricidae) from Thailand. Salamandra 45 (3): 165–169.

Rao DQ, Yang DT (1998) A new species of *Sinonatrix* (Serpentes: Colubridae) of China. Russian Journal of Herpetology 5(1): 70–73. https://doi.org/10.30906/1026-2296-1998-5-1-70-73

Ren J, Wang K, Guo P, Wang Y, Nguyen TT, Li J (2019) On the generic taxonomy of *Opisthotropis balteata* (Cope, 1895) (Squamata: Colubridae: Natricinae): taxonomic revision of two natricine genera. Asian Herpetological Research 10 (2):105–128. https://doi.org/10.16373/j.cnki.ahr.180091

Shorthouse DP (2022) SimpleMappr, an online tool to produce publication-quality point maps. http://www.simplemappr.net. Accessed on: 2022-2-3.

Thorpe RS (1975) Quantitative handling of characters useful in snake systematics with particular reference to intraspecific variation in the Ringed Snake *Natrix natrix* (L.). Biological Journal of the Linnaean Society 7 (1): 27–43. https://doi.org/10.1111/j.1095-8312.1975.tb00732.x

Uetz P, Freed P, Aguilar R, Hošek J (Eds.) (2021) The reptile database. http://www.reptile-database.org. Accessed on: 2021-10-20.

Wogan GOU, Vindum JV, Wilkinson JA, Koo MS, Slowinski JB, Win H, Thin T, Kyi SW, Oo SL, Lwin KS, Shein AK (2008) New country records and range extensions for Myanmar's amphibians and reptiles. Hamadryad 33 (1): 83–96.